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KINGSTON WATER TREATMENT PLANT

DRINKING WATER SURVEILLANCE PROGRAM

ANNUAL REPORT - 1986

MAY, 1987

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Ministry of the Environment
Ontario

J. Bishop, Director
Water Resources Branch

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ONTARIO MINISTRY OF THE ENVIRONMENT

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Southeastern Region

KINGSTON WATER TREATMENT PLANT

Location:	302 King Street West Kingston, Ontario K7L 2X1 (613-542-1763)
Source:	Lake Ontario
Design Capacity:	94.4 1000 M3/day
Operation:	Municipal
Plant Superintendent:	K. Allen
Ministry Region:	Southeastern Region Kingston Regional Office 133 Dalton Avenue, P.O. Box 820 Kingston, Ontario K7L 4X6 (613-549-4000)
Municipalities Served:	Kingston (60,500) Part of Pittsburgh Township (1,600) CFB, Kingston (4,500)
Treatment Type:	Physical and chemical treatment consisting of coagulation, flocculation, sedimentation and filtration (conventional) and disinfection.
Chemicals Used:	Prechlorination - chlorine Coagulation - alum liquid Dechlorination - sulphur dioxide Post chlorination - chlorine

KINGSTON WATER TREATMENT PLANT

EXECUTIVE SUMMARY
DRINKING WATER SURVEILLANCE PROGRAM, 1986

The Kingston Water Treatment Plant was sampled 13 times in 1986; results are given for raw and treated samples.

The parameters analyzed fall into several categories: physical parameters and general chemistry, bacterial parameters, metals, and organic substances including volatile and chloroaromatic substances and pesticides.

The discussion of results focuses on health-related parameters found in treated water:

(a) **Organic Substances**

Analysis was carried out for approximately 110 organic compounds. The only volatile compounds found, trihalomethanes (THMs) were always present in treated waters; the highest level recorded for total THMs was 51 ug/L.

None of the pesticides analyzed for was found.

No chlorophenolic or chloroaromatic compounds were found.

(b) **Other Parameters**

The aesthetic ODWO* for organic nitrogen was exceeded in six treated water samples; the ODWO for turbidity was exceeded marginally once. Of the other physical, general chemistry and microbiological parameters and metals analyzed, for which there are health-related ODWO, none exceeded the objectives, in treated water.

The results of these analyses are consistent with those obtained in other areas of the Great Lakes.

The treated water from the supply did not exceed any known health-related guidelines for organic substances applicable to drinking water.

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* The Ontario Drinking Water Objectives, revised 1983.

KINGSTON WATER TREATMENT PLANT

SUMMARY TABLE OF RESULTS
DRINKING WATER SURVEILLANCE PROGRAM, 1986

The Kingston Water Treatment Plant was sampled 13 times in 1986.

PARAMETER CATEGORY	TYPE OF SAMPLE RAW	TREATED*
1. GENERAL CHEMISTRY - includes anions such as sulphate, field analyses such as chlorine residual and physical parameters such as colour.		
Total number of parameters in category: **21**		
- Total number of analyses completed	234	234
- Total number of positive results	214	165
- **Number of times guidelines exceeded**	**N/A**	**7**
Guidelines exceeded - aesthetic ODWO** for organic nitrogen (6) - ODWO for turbidity (1)		
2. METALS - includes metals such as copper and lead.		
Total number of parameters in category: **24**		
- Total number of analyses completed	279	279
- Total number of positive results	137	128
- **Number of times guidelines exceeded**	**N/A**	**0**
3. BACTERIOLOGY - includes bacteria such as coliforms.		
Total number of parameters in category: **5**		
- Total number of analyses completed	48	52
- Total number of positive results	37	10
- **Number of times guidelines exceeded**	**N/A**	**0**
4. VOLATILES - includes compounds such as benzene and toluene; also included in this category are trihalomethanes (5 parameters), acknowledged to be produced during water treatment.		
Total number of parameters in category: **29**		
- Total number of analyses completed	364	365
- Total number of positive results	0	48
- **Number of times guidelines exceeded**	**N/A**	**0**
5. PESTICIDES -		
Total number of parameters possible in category: **65**		
- Total number of analyses completed	430	430
- Total number of positive results	0	0
- **Number of times guidelines exceeded**	**N/A**	**0**
6. CHLOROAROMATICS AND CHLOROPHENOLS - includes a range of chlorinated organic compounds.		
Total number of parameters possible in category: **19**		
- Total number of analyses completed	181	181
- Total number of positive results	0	0
- **Number of times guidelines exceeded**	**N/A**	**0**

* Total number of analyses completed will not always equal the number of parameters analyzed for multiplied by number of times the supply was sampled, because of accidents during shipping or analyses or analytical difficulties.

** Ontario Drinking Water Objective.

DRINKING WATER SURVEILLANCE PROGRAM

The Drinking Water Surveillance Program (DWSP) for Ontario is a computerized drinking water information system. The objectives of this program are to provide:

- immediate, reliable, current information on drinking water quality,
- a flagging mechanism for 'Objective' exceedence,
- a definition of contaminant levels and trends,
- a comprehensive background for remedial action,
- a framework for assessment of new contaminants,
- an indication of treatment efficiency of plant processes.

Program

The DWSP began in April 1986 and is designed to eventually include all municipal water supplies in Ontario. Water supply locations have been prioritized for surveillance, based primarily on such criteria as population density, probability of contamination and geographical location.

Once the data base becomes established, an assessment of monitoring requirements for the future will be made; monitoring will be continued at the initial locations at an appropriate level and further locations will be phased on to the program as resources permit. It is

estimated that after 4 years of operation, the program will be monitoring 90 locations.

A major goal of the program is to collect valid water quality data, in context with plant operation characteristics in the plant at the time of sampling.

Assessments are carried out at all locations prior to sampling in order to acquire full plant process and distribution system details, and to designate (and retrofit if necessary) all sampling systems and locations.

Samples are taken of the raw (ambient water quality) and treated water at the treatment plants, and also in the distribution systems. In order to determine possible effects of distribution on water quality, both standing and flowing water in old and new sections of the distribution system are sampled. Sampling is carried out by Ministry of the Environment (MOE) Regional staff and/or Municipal personnel who have been trained in the applicable procedures. Comprehensive sampling kits and documented sampling procedures are made available to samplers. This ensures that samples are taken and shipped according to standard protocols and that field testing will supply reliable data. All analyses are carried out using approved documented procedures.

Data Reporting Mechanism

Final analytical results are usually received by the DWSP reporting system within 6 weeks of the time of sampling. At this time, printouts of the completed analyses are sent to the MOE District Officer and the appropriate MOE regional office, and are also retained by the DWSP co-ordinator. The DWSP is able to monitor analysis results and assess trends. Should the level of

a contaminant exceed a health-related Ontario Drinking Water Objective, action is required as outlined in the publication, Ontario Drinking Water Objectives.* The DWSP issues an "Action Alert" which notifies appropriate MOE and health authorities, and supplies a history of the occurrence of the contaminant in the water supply system concerned.

Parameters Analyzed

About one hundred and forty (140) different parameters are routinely measured on DWSP covering microbiological, organic and inorganic substances of concern, as well as process parameters.

Parameters included in the program are based on the following criteria:

- probability that the substance has the potential to cause problems (health-related or aesthetic);
- probability of occurrence in ambient water;
- availability of routine analytical and sampling methods for monitoring and control purposes;
- feasibility of control.

The range of parameters includes those having Ontario Drinking Water Objectives (ODWO), World Health Organization Drinking Water Guideline values, or other

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* Ontario Drinking Water Objectives, revised 1983, published by the Ontario Ministry of the Environment.

jurisdiction's drinking water objectives (e.g. State of California) as well as compounds of concern to other agencies such as the International Joint Commission, and U.S. Environmental Protection Agency.

The parameters monitored routinely during 1986 are shown in Table 1; this table also includes available guidelines which are appropriate for drinking water, and the analytical detection limit (the lowest concentration that can be detected by laboratory analysis) for each parameter.

Analyses for additional pesticides may be included on certain sampling dates; such additional pesticides are selected from the list shown in Table 1A. These analyses may be done on a seasonal basis, in response to an identified concern or because of a potential for occurrence in certain locations. Seasonal analyses for specified additional pesticides are normally carried out at times corresponding to maximal agricultural use or run-off periods, i.e. in spring and fall seasons.

Drinking Water Guidelines

The Ministry of the Environment published a revised edition of "Ontario Drinking Water Objectives" in 1983.

The primary purpose of drinking water objectives is the protection of the health of the public consuming the water. Aesthetic considerations may also provide a basis for drinking water objectives, since the water should be pleasant to drink. The control of such aspects of water quality as hardness, corrosiveness, etc. is also important. The limits set are considered to outline the minimum requirements necessary to fulfill the above objectives, and may be either health-related or related to aesthetic and other considerations.

Because this survey covered such a large number of parameters, many of them did not have an ODWO. In order to be able to compare data results to health guidelines, it was necessary to refer to objectives and guidelines developed by other jurisdictions.

The footnotes to Table 1 indicate the sources and derivation of the various guidelines.

TABLE 1: DRINKING WATER SURVEILLANCE PROGRAM, PARAMETERS ANALYSED

PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit	PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit
CHEMISTRY:			Barium	1 mg/L	0.001 mg/L
Conductivity	-	0.01 UMHO/CM	Boron	5 mg/L	0.02 mg/L
			Beryllium	-	0.001 mg/L
Hardness	-	0.5 mg/L	Cyanide	0.2 mg/L	0.001 mg/L
Calcium	-	0.1 mg/L	Cadmium	0.005 mg/L	0.0003 mg/L
Magnesium	-	0.05 mg/L	Cobalt	-	0.001 mg/L
Sodium	-	0.1 mg/L	Chromium	0.05 mg/L	0.001 mg/L
Alkalinity		0.2 mg/L	Copper	1 mg/L	0.001 mg/L
pH	-	-	Mercury	1 µg/L	0.01 µg/L
Fluoride	2.4 mg/L	0.01 mg/L	Molybdenum	-	0.001 mg/L
Chloride	250 mg/L	0.2 mg/L	Nickel	-	0.002 mg/L
Residue total (solids)	-	1 mg/L	Lead	0.05 mg/L	0.003 mg/L
Turbidity	1 FTU	.01 FTU	Selenium	0.01 mg/L	0.001 mg/L
Phosphorus	-	0.002 mg/L	Strontium	-	0.001 mg/L
Phosphates	-	0.0005 mg/L	Vanadium	-	0.001 mg/L
Nitrogen Total Kjeldahl	0.15 mg/L*	0.1 mg/L	Zinc	5 mg/L	0.001 mg/L
Ammonium Total	-	0.05 mg/L			
Colour	5 TCU	0.5 TCU	BACTERIOLOGY (RAW ONLY):		
Nitrates Total	10 mg/L as N	.05 mg/L	Total Coliform MF	-	0
			Total Coliform MF BKGD	-	0
Nitrite	1 mg/L as N	0.0005 mg/L	Fecal Coliform	-	0
			Standard Plate Count MF	-	0
METALS:			(TREATED ONLY):		
Uranium	0.02 mg/L(t)	0.002 mg/L‡	Present/Absent (P/A) Test	Absent	Absent
Iron	0.3 mg/L	0.002 mg/L	Total Coliform MF BKGD	-	0
Manganese	0.05 mg/L	0.001 mg/L	Fecal Coliform	0	0
Aluminum	-	0.003 mg/L	Standard Plate Count MF	<500 orgs/mL	0
Arsenic	0.05 mg/L	0.001 mg/L			

TABLE 1: DRINKING WATER SURVEILLANCE PROGRAM, PARAMETERS ANALYSED (cont'd)

PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit	PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit
VOLATILES:			CHLOROAROMATICS:		
1,1-Dichloroethylene	0.3 µg/L(h)	1.0 µg/l	Hexachloroethane	19000 ng/L(e)	1 ng/L
Dichloromethane	40 µg/L(c)	5 µg/L	1,3,5-Trichlorobenzene	10000 ng/L(y)	5 ng/L
TRS-1,2-Dichloroethylene	-	1 µg/L	1,2,4-Trichlorobenzene	15000 ng/L(y)	5 ng/L
1,1-Dichloroethane	-	1 µg/L	Hexachlorobutadiene	4500 ng/L(e)	1 ng/L
Chloroform	350 µg/L++	1 µg/L	1,2,3-Trichlorobenzene	10000 ng/L(y)	5 ng/L
1,1,1-Trichloroethane	1000 µg/L(c)	1 µg/L	2,4,5-Trichlorotoluene	-	5 ng/L
1,2-Dichloroethane	10 µg/L(h)	1 µg/L	2,3,6-Trichlorotoluene	-	5 ng/L
Carbon Tetrachloride	3 µg/L(h)	1 µg/L	1,2,3,5-Tetrachloro-		
Benzene	10 µg/L(h)	1 µg/L	benzene	-	1 ng/L
1,2-Dichloropropane	-	1 µg/L	1,2,4,5-Tetrachloro-		
Trichloroethylene	30 µg/L(h)	1 µg/L	benzene	38000 ng/L(e)	1 ng/L
Dichlorobromomethane	350 µg/L++	1 µg/L	2,6,A-Trichlorotoluene	-	5 ng/L
Toluene	100 µg/L(c)	1 µg/L	1,2,3,4-Tetrachloro-		
1,1,2-Trichloroethane	6 µg/L(e)	1 µg/L	benzene	-	1 ng/L
Chlorodibromomethane	350 µg/L++	1 µg/L	Pentachlorobenzene	74000 ng/L(e)	1 ng/L
Tetrachloroethylene	10 µg/L(h)	1 µg/L	Total PCB's	3000 ng/L(t)	20 ng/L
Chlorobenzene	100-300 ng/L(h)*	1 ng/L			
Trifluorochlorotoluene	-	1 µg/L	PESTICIDES:		
Ethylbenzene	1400 µg/L(e)	1 µg/L	Hexachlorobenzene	10 ng/L(h)	1 ng/L
Ethylene Dibromide	0.02 µg/L(x)	1 µg/L	Heptachlor	3000 ng/L+++	1 ng/L
P-Xylene	620 µg/L(c)	1 µg/L	Aldrin	700 ng/L**	1 ng/L
M-Xylene	620 µg/L(c)	1 µg/L	PP-DDE	d	1 ng/L
O-Xylene	620 µg/L(c)	1 µg/L	Mirex	-	5 ng/L
Total Trihalomethanes	350 µg/L++	3 µg/L	Alpha BHC	700 ng/L(c)	1 ng/L
Bromoform	350 µg/L++	1 µg/L	Beta BHC	300 ng/L(c)	1 ng/L
1,1,2,2-Tetrachloroethane	1.7 µg/L(e)	1 µg/L	Gamma BHC (Lindane)	4000 ng/L	1 ng/L
1,4-Dichlorobenzene	400 µg/L(e)	1 µg/L	Alpha Chlordane	7000 ng/L***	2 ng/L
1,3-Dichlorobenzene	400 µg/L(e)	1 µg/L	Gamma Chlordane	7000 ng/L***	2 ng/L
1,2-Dichlorobenzene	400 µg/L(e)	1 µg/L	Oxychlordane	-	2 ng/L

TABLE 1: DRINKING WATER SURVEILLANCE PROGRAM, PARAMETERS ANALYSED (cont'd)

PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit	PARAMETER CATEGORY	Objective Guideline (1)	Detection Limit
Pesticides (cont'd)					
OP-DDT	30000 ng/L(d)	5 ng/L			
PP-DDD	d	5 ng/L			
PP-DDT	d	5 ng/L			
Methoxychlor	100000 ng/L	5 ng/L			
Heptachlor Epoxide	3000 ng/L+++	1 ng/L			
Endosulfan 1	74000 ng/L(ea)	2 ng/L			
Dieldrin	700 ng/L**	2 ng/L			
Endrin	200 ng/L	4 ng/L			
Endosulfan 2	74000 ng/L(ea)	4 ng/L			
Endosulfan Sulphate	-	4 ng/L			
Octachlorostyrene	-	1 ng/L			
Toxaphene	5000 ng/L	PA(xx)			

Footnotes:

(l) = Ontario Drinking Water Objectives (ODWO) for drinking water, unless noted.

(t) = ODWO Interim maximum acceptable concentration (IMAC) for drinking water.

(c) = California State Department of Health Action Level for drinking water.

(d) = ODWO for DDT (contains other isomers such as OPDDT and PPDDT).

(e) = US EPA ambient guideline; guideline levels when it is assumed that untreated water and fish and shellfish are consumed from the same body of water.

(ea) = United States Environmental Protection Agency (US EPA) ambient level for endosulfan (contains other isomers).

(h) = World Health Organization (WHO) guideline for drinking water.

(h)* = World Health Organization (WHO) Odour Threshold for drinking water.

(x) = State of Florida, maximum contaminant level for drinking water.

(xx) = the presence of toxaphene is detected in scan used; positive samples would be quantified by special additional analysis.

(y) = New York State (Taste and Odour) proposed drinking water guideline.

++ = total Trihalomethanes.

+++ = combined total; Heptachlor and Heptachlor Epoxide.

* = total Kjeldahl Nitrogen minus Ammonia Nitrogen.

** = total of Aldrin and Dieldrin.

*** = Chlordane is a mixture of alpha and gamma isomers.

‡ = Analysis changed to mass spectrometry method in mid-1986, detection limit 0.0001 mg/L.

TABLE 1A: DRINKING WATER SURVEILLANCE PROGRAM SPECIAL PESTICIDES

Dicamba	Reldan
2,4-D	Ronnel
2,4-DB	Carbofuran
2,4-DP	Propoxur
2,4,5-T	IPC
Silvex (2,4,5-TP)	Aminocarb
Picloram	CIPC
2,4,6-Trichlorophenol	Eptam
2,4,5-Trichlorophenol	Benonyl
2,3,4-Trichlorophenol	Bux
2,3,5,6-Tetrachlorophenol	Diallate
2,3,4,5-Tetrachlorophenol	Sevin
Pentachlorophenol	Sutan
Diazinon	Propazine
Dichlorvos	Atrazine
Dursban	Simazine
Ethion	Sencor (metribuzin)
Guthion	Bladex (Cyanazine)
Malathion	Prometone
Mevinphos	Ametryne
Methyl Parathion	Prometryne
Methyl Trithion	Atratone
Parathion	Alachlor
Phorate (Thimet)	Metolachlor

RESULTS AND DISCUSSION

The parameters analyzed fall into several categories: physical parameters and general chemistry (chemistry), bacterial parameters, metals, and organic substances including volatile and chloroaromatic substances and pesticides. Many of the substances analyzed for are naturally-occurring or treatment by-products.

The results of analysis of raw and treated water samples are shown in Tables 2 and 3. Table 2 shows the categories of parameters analyzed, as well as the total number of analyses which were completed in each category for both raw and treated water samples and the total number of positive results which were obtained. Table 3 lists the sampling dates and the numerical values for each parameter for which analysis produced a positive (quantifiable) result.

The Kingston Water Treatment Plant was sampled 13 times in 1986.

(a) Non Organic Substances

There are 379 positive results of 468 reported analyses for physical parameters, such as pH and temperature and general chemistry tests. The results of these tests are used as an indication of the analytical validity and integrity of the samples, the general characteristics of the water, and as a guide to making an assessment of the treatment process; they may also indicate whether any changes occur during the time elapsing between sampling and actual analysis. Turbidity marginally exceeded the ODWO in treated water on only one occasion (November 3, 1986) at 1.06 FTU. Turbidity may interfere with disinfection and with the

maintenance of a chlorine residual. Although the DWSP system generated an action alert, comparison with the corresponding field turbidity indicated that the result was probably an error in sample identification. Organic nitrogen exceeded the aesthetic ODWO in 6 treated water samples; levels of organic nitrogen above the limit can result in taste and odour problems.

Positive results were obtained for 47 analyses for bacterial parameters out of a total number reported of 100. These bacterial tests include those for species of paramount importance from a public health point of view, and those which assess the general bacteriological quality and characteristics of the water; by this means, a measure is obtained of the overall efficiency of water treatment processes. Positive results were obtained for treated water samples for standard plate count (a measure of the total number of bacteria in a water sample); levels were for the most part below 10 organisms per mL with 1 sample on March 3, 1986 containing 11 organisms per mL, and a further sample on July 7, 1986 with 580 organisms per mL. The ODWO limit for standard plate count is 500 organisms per mL, based, however, on the geometric mean of 5 or more samples. This limit was, therefore, not exceeded. A further positive result occurred when 2 total coliforms per mL occurred in the treated water on May 5, 1986 only. The ODWO for "poor water quality" states that "where total coliform bacteria are present at levels below 5 organisms per 100 mL, they should not occur in more than 25% of the samples in a single submission, nor in successive submissions from the same sampling site". Therefore, the ODWO were not exceeded.

Analyses of 558 tests for metals in the water samples were reported; of these 265 were positive results. Metals can occur naturally and most are generally regarded as being ubiquitous. However, some may be present in water as a result of industrial or other discharges. A small number of metals have public health significance.

Of those parameters discussed above for which there are ODWO, none exceeded the Objectives, with the exception of turbidity and organic nitrogen. Nor did the levels exceed any guidelines for drinking water set by other jurisdictions, such as the U.S. Environmental Protection Agency (US EPA), the World Health Organization (WHO) and Health & Welfare, Canada (H&W, Canada). Furthermore, the results of these analyses are consistent with those obtained in other areas of the Great Lakes.

(b) <u>Organic Substances</u>

Of a total of 729 analyses for volatile organic compounds, 48 were positive: these were from treated water samples and were all due to the presence of trihalomethanes.

Trihalomethanes (THMs) are acknowledged to be produced during the water treatment process and will almost always only occur in treated waters. Trihalomethanes are comprised mainly of chloroform, chlorodibromomethane and dichlorobromomethane with bromoform occurring occasionally. Results are reported for the individual compounds as well as for their sum, which is expressed as total trihalomethanes (total THM). The ODWO for total THM is 350 ug/L; this level was not exceeded in any of the water samples included in this report, the

highest level recorded being 51 ug/L on May 5, 1986.

Six hundred and sixteen (616) tests were carried out for twenty three routine pesticides; none was found above trace levels. Seven special pesticides (dicamba, 2,4-D propionic acid, 2,4-D, Silvex, 2,4,5-T, 2,4-D butyric acid and picloram) were analyzed for in both raw and treated water on three occasions (April 7, 1986; August 4, 1986; October 6, 1986). As of April 17, 1986 the following pesticides were monitored on a monthly basis: ametryne, prometone, propazine, atrazine, prometryne, simazine, Sencor, Bladex and atratone. As of August 4, 1986 alachlor and metolachlor were added to the above group. None of the special pesticides occurred at quantifiable levels in raw or treated water. Special pesticide analysis is carried out at each supply, on a seasonal basis, to correspond to the use and/or loss of such pesticides on agricultural land.

Of the 338 chloroaromatic tests conducted, there were no positive results.

Six chlorophenolic compounds (2,4,6-Trichlorophenol; 2,4,5-Trichlorophenol; 2,3,4-Trichlorophenol; 2,3,5,6-Tetrachlorophenol; 2,3,4,5-Tetrachlorophenol; and pentachlorophenol) were analyzed for in both raw and treated water on August 4, 1986 and October 6, 1986; no positive results were obtained in either raw or treated water.

CONCLUSIONS

The data reveal that for metals, inorganic ions, and bacterial parameters, raw water values are frequently in the detectable range; levels of metals and inorganics are also found in treated water. The levels of metals, inorganic compounds, and bacteria are consistent with those found in other water supplies in the province.

For the organic compounds, most are below detection levels, even though the most sophisticated equipment available was employed in the chemical analysis.

ODWO have not been established for some of the compounds analyzed; for these few compounds, use was made of appropriate guidelines set by other agencies, such as the World Health Organization, the US Environmental Protection Agency, Health and Welfare Canada or other agencies. None of these guidelines was exceeded.

The treated water at the supply did not exceed any known health-related guidelines for organic substances applicable to drinking water.

TABLE 2

KINGSTON WATER TREATMENT PLANT

	PARAMETER GROUP	TYPE OF SAMPLE RAW	TREATED
1.	GENERAL CHEMISTRY		
	- Total samples	234	234
	- Total positives	214	165
2.	METALS		
	- Total samples	279	279
	- Total positives	137	128
3.	BACTERIOLOGY		
	- Total samples	48	52
	- Total positives	37	10
4.	VOLATILES		
	- Total samples	364	365
	- Total positives	0	48
5.	PESTICIDES		
	- Total samples	308	308
	- Total positives	0	0
6.	CHLOROAROMATICS		
	- Total samples	169	169
	- Total positives	0	0
7.	CHLOROPHENOLS		
	- Total samples	12	12
	- Total positives	0	0
8.	SPECIAL PESTICIDES		
	- Total samples	122	122
	- Total positives	0	0

Table 3

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/8

PARAMETERS	UNITS		SAMPLE DATE 86/01/06	86/02/03	86/03/03	86/04/07	86/05/05	86/06/02	86/07/07	86/08/04	86/09/02	86/09/10	86/10/06
ALKALINITY	MG/L-CAC	R	97.200	98.000	96.600	100.50	105.30	102.40	98.000	102.30	111.20	103.80	141.50
		T	91.800	92.600	90.800	94.300	98.900	96.200	92.100	94.700		89.500	91.300
ALUMINUM	MG/L-AL	R	.050	.028	.034	.056		.029		.017	.005	.024	.036
		T	.072	.065	.063	.071	.150	.085	.230	.110	.044	.180	.170
ARSENIC	MG/L-AS	R	.001	.001	.002				.002				
		T							.001				
BARIUM	MG/L-BA	R	.019	.019	.018	.019	.026	.022	.021	.031	.046	.037	.060
		T	.018	.019	.018	.017	.024	.021	.021	.020	.023	.022	.023
BORON	MG/L-BO	R	.040	.050	.090		.030	.030	.030	.030	.040	.050	.040
		T		.050	.050		.030	.030	.030	.030	.030	.030	.030
CALCIUM	MG/L-CA	R	40.000	38.500	39.000	40.900	41.300	40.900	39.400	40.000	44.400	40.900	56.600
		T	40.000	38.000	39.000	40.400	41.300	40.100	39.600	39.800		38.200	38.800
CHLORIDE	MG/L-CL	R	22.200	23.800	24.000	22.700	17.500	21.500	24.000	23.500	23.500	23.500	23.000
		T	23.200	25.000	24.800	24.100	19.350	23.000	25.500	24.500		25.000	24.000
COLOUR	HZU	R	5.500	5.000	4.000	2.500	9.000	5.000	2.500	3.000	2.500	2.500	3.500
		T					3.500						
CONDUCTIVITY	UMHO/CM	R	314.00	329.00	322.00	320.00	298.00	323.00	326.00	322.00	338.00	328.00	410.00
		T	318.00	334.00	325.00	325.00	297.00	327.00	330.00	322.00		315.00	324.00
COBALT	MG/L-CO	R											.001
		T		.001									
CHROMIUM	MG/L-CR	R	.003	.002	.002	.003							
		T	.002	.002	.002	.001						.001	.001
COPPER	MG/L-CU	R	.076	.056	.071	.064	.081	.097	.052	.110	.170	.098	.220
		T	.003	.004	.003	.004	.002	.002	.001	.001	.001	.002	.002

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/01/06	86/02/03	86/03/03	86/04/07	86/05/05	86/06/02	86/07/07	86/08/04	86/09/02	86/09/10	86/10/06
FECAL COLIFORM MEMBRANE FILTRATION	CT/100ML	R								5.000	2.000		
		T											
IRON	MG/L-FE	R	.036	.012	.015	.036	.024	.014		.150	.012	.019	.015
		T		.004			.015		.002		.001	.007	.007
FLUORIDE	MG/L-F	R	.150	.140	.160	.150	.110	.150	.160	.150	.120	.170	.200
		T	.120	.140	.140	.140	.100	.130	.140	.150		.120	.150
FIELD COMBINED CHLORINE RESIDUAL	MG/L-CL	R											
		T	.130	.130	.120	.130	.190	.130	.120	.120	.160	.200	.170
FIELD FREE CHLORINE RESIDUAL	MG/L-CL	R											
		T	.400	.150	.380	.320	.260	.340	.420	.350	.240	.300	.300
FIELD TOTAL CHLORINE RESIDUAL	MG/L-CL	R											
		T	.530	.380	.500	.450	.450	.470	.540	.470	.400	.500	.470
FIELD PH		R	7.900	8.100	7.850	7.980	8.100	7.900	8.300	7.700	7.500	7.700	7.800
		T	7.400	7.550	7.500	7.550	7.500	7.450	7.550	7.400	7.300	7.550	7.600
FIELD TEMPERATURE	DEG.C	R	.600	.500	.100	2.000	7.100	8.200	16.000	17.000	11.500	18.000	17.000
		T	.600	.500	.400	2.000	7.100	11.000	16.000	18.000	13.000	17.500	16.000
FIELD TURBIDITY	FTU	R	2.000	1.000	.800	1.300	.710	.750	.600	1.000	.700	.900	.500
		T	.100	.070	.060	.090	.200	.080	.090	.080	.060	.850	.080
HARDNESS	MG/L-CAC	R	132.00	130.30	133.00	134.50	131.00	134.00	131.50	134.00	146.00	138.00	182.50
		T	133.00	129.10	134.00	134.00	131.00	131.50	131.50	133.50		128.00	130.00
STANDARD PLATE COUNT MEMBRANE FILT.	CT/ML	R	7.000	3.000	3.000	11.000	11.000	11.000		127.00			640.00
		T	3.000	1.000	11.000	4.000	1.000		580.00		9.000		8.000

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/01/06	86/02/03	86/03/03	86/04/07	86/05/05	86/06/02	86/07/07	86/08/04	86/09/02	86/09/10	86/10/06
MERCURY	UG/L-HG	R			.010	.010	.010						
		T	.010		.020		.010				.010		.020
MAGNESIUM	MG/L-MG	R	7.900	8.300	8.700	7.950	6.800	7.800	8.050	8.300	8.550	8.650	10.100
		T	8.100	8.300	8.800	8.100	6.750	7.650	7.900	8.250		7.950	8.000
MANGANESE	MG/L-MN	R	.004	.003	.002	.004	.003	.005	.003	.006	.015	.019	.048
		T	.001	.001	.001	.001	.001		.001				
MOLYBDENUM	MG/L-MB	R	.002			.001			.001		.001	.001	.001
		T	.002	.001		.001			.001	.001	.001	.001	.001
SODIUM	MG/L-NA	R	11.500	12.500	12.000	12.000	9.200	11.500	12.000	12.100	12.100	12.100	12.600
		T	11.500	12.000	12.000	12.200	9.500	11.200	12.000	12.200		12.100	12.000
NICKEL	MG/L-NI	R	.002	.002	.001	.002	.002	.002		.002			
		T	.001	.002	.002	.001		.002			.002	.002	
AMMONIUM TOTAL	MG/L-N	R	.028	.022	.010	.014	.020	.034	.044	.024	.012	.026	
		T	.028	.014		.008	.008	.006		.016		.016	.012
NITRITE	MG/L-N	R	.002	.002		.005	.003	.005	.004		.003	.002	.004
		T	.002			.004		.004	.003			.002	.004
TOTAL NITRATES	MG/L-N	R	.325	.365	.375	.325	.345	.335	.270	.255	.290	.160	.200
		T	.325	.355	.375	.320	.335	.305	.250	.250		.175	.130
NITROGEN TOTAL KJELDAHL	MG/L-N	R	.260	.190	.190	.230	.330	.260	.260	.210	.170	.220	.200
		T	.190	.150	.140	.150	.230	.150	.180	.180		.190	.190
LEAD	MG/L-PB	R											.007
		T											.005
PH		R	8.110	8.130	8.200	8.320	8.350	8.270	8.310	8.350	8.380	8.300	8.230
		T	7.600	7.690	7.720	8.050	8.080	7.980	8.000	8.080		8.080	8.100

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/01/06	86/02/03	86/03/03	86/04/07	86/05/05	86/06/02	86/07/07	86/08/04	86/09/02	86/09/10	86/10/06
PHOSPHORUS FIL REACT	MG/L-P	R	.007	.006	.005	.003			.005	.008	.021	.013	.021
		T											
PHOSPHORUS TOTAL	MG/L-P	R	.018	.007	.006	.015	.009	.012	.014	.018	.021	.018	.024
		T							.018			.006	
TOTAL SOLIDS	MG/L	R	204.00 CRO	214.00 CRO	209.00 CRO	195.00	194.00 CRO	210.00 CRO	232.00	240.00	235.00	213.00 CRO	263.00
		T	207.00 CRO	217.00 CRO	211.00 CRO	211.00 CRO	193.00 CRO	213.00 CRO	215.00 CRO	209.00 CRO		205.00 CRO	211.00 CRO
STRONTIUM	MG/L-SR	R	.190	.160	.170	.170	.190	.190	.180	.470	.850	.590	1.500
		T	.170	.180	.170	.170	.190	.190	.180	.160	.170	.170	.180
TOTAL COLIFORM MEMBRANE FILTRATION	CT/100ML	R	4.000	2.000		7.000	2.000			32.000 A3C	8.000	24.000	10.000
		T					2.000						
TOTAL COLIFORM BACKGROUND MF	CT/100ML	R	28.000	14.000	6.000	13.000	4.000		5.000	1900.0	380.00	420.00	210.00
		T											
TURBIDITY	FTU	R	1.700	1.480		1.800				1.540			
		T											
URANIUM	UG/L-U	R								.350	.310	.320	.360
		T								.270	.270	.310	.330
VANADIUM	MG/L-V	R											
		T										.001	
CHLOROFORM	UG/L	R											
		T	15.000	11.000	14.000	23.000	39.000	24.000	23.000	20.000	14.000	18.000	15.000
DICHLOROBROMOMETHANE	UG/L	R											
		T	10.000	9.000	11.000	13.000	9.000	8.000	15.000	14.000	11.000	12.000	11.000

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE										
			86/01/06	86/02/03	86/03/03	86/04/07	86/05/05	86/06/02	86/07/07	86/08/04	86/09/02	86/09/10	86/10/06
CHLORODIBROMOMETHANE	UG/L	R											
		T	10.000	13.000	24.000	13.000	3.000	2.000	9.000	6.000	5.000	6.000	2.000
TOTAL TRIHALOMETHANES	UG/L	R											
		T	35.000	33.000	49.000	49.000	51.000	34.000	47.000	40.000	30.000	36.000	28.000
ZINC	MG/L-ZN	R	.003	.005	.006	.004	.002	.005	.001	.004	.005	.001	.003
		T	.002	.004	.001	.003	.003	.002	.004	.003	.001	.020	

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/11/03	86/12/01									
ALKALINITY	MG/L-CAC	R	91.200	108.70									
		T	106.20	95.900									
ALUMINUM	MG/L-AL	R	.042	.020									
		T	.130	.071									
ARSENIC	MG/L-AS	R		.001									
		T											
BARIUM	MG/L-BA	R	.039	.031									
		T	.025	.022									
BORON	MG/L-BO	R	.020	.020									
		T	.020	.040									
CALCIUM	MG/L-CA	R	37.700	41.300									
		T	42.300	38.300									
CHLORIDE	MG/L-CL	R	24.500	23.400									
		T	23.000	24.300									
COLOUR	HZU	R		4.000									
		T											
CONDUCTIVITY	UMHO/CM	R	315.00	335.00									
		T	332.00	325.00									
COPPER	MG/L-CU	R	.076	.076									
		T	.001	.003									
IRON	MG/L-FE	R	.025	.020									
		T	.018	.005									
FLUORIDE	MG/L-F	R	.140	.150									
		T	.150	.130									

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/11/03	86/12/01									
FIELD COMBINED CHLORINE RESIDUAL	MG/L-CL	R											
		T	.170	.160									
FIELD FREE CHLORINE RESIDUAL	MG/L-CL	R											
		T	.320	.350									
FIELD TOTAL CHLORINE RESIDUAL	MG/L-CL	R											
		T	.490	.510									
FIELD PH		R	7.900	7.800									
		T	7.600	7.550									
FIELD TEMPERATURE	DEG.C	R	12.000	6.000									
		T	12.000	7.000									
FIELD TURBIDITY	FTU	R	1.100	.900									
		T	.080	.080									
HARDNESS	MG/L-CAC	R	126.50	138.50									
		T	139.50	129.00									
STANDARD PLATE COUNT MEMBRANE FILT.	CT/ML	R	136.00	21.000									
		T		3.000									
MERCURY	UG/L-HG	R	.010										
		T	.010										
MAGNESIUM	MG/L-MG	R	7.800	8.600									
		T	8.250	8.100									
MANGANESE	MG/L-MN	R	.015	.006									
		T											

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/87

PARAMETERS	UNITS		SAMPLE DATE 86/11/03	86/12/01									
MOLYBDENUM	MG/L-MB	R	.001	.001									
		T	.001	.001									
SODIUM	MG/L-NA	R	11.900	10.300									
		T	12.300	10.800									
AMMONIUM TOTAL	MG/L-N	R	.010										
		T	.020										
TOTAL NITRATES	MG/L-N	R	.235	.270									
		T	.205	.295									
NITROGEN TOTAL KJELDAHL	MG/L-N	R		.160									
		T		.140									
LEAD	MG/L-PB	R	.004										
		T											
PH		R	7.910	8.220									
		T	8.170	8.040									
PHOSPHORUS FIL REACT	MG/L-P	R		.007									
		T	.007										
PHOSPHORUS TOTAL	MG/L-P	R		.013									
		T	.010										
TOTAL SOLIDS	MG/L	R	205.00 CRO	218.00 CRO									
		T	216.00 CRO	211.00 CRO									
STRONTIUM	MG/L-SR	R	.540	.490									
		T	.180	.180									
TOTAL COLIFORM MEMBRANE FILTRATION	CT/100ML	R	14.000	18.000									
		T											

Table 3 (cont'd)

KINGSTON WATER TREATMENT PLANT DWSP RESULTS

02/17/9

PARAMETERS	UNITS		SAMPLE DATE 86/11/03	86/12/01									
TOTAL COLIFORM BACKGROUND MF	CT/100ML	R	314.00	102.00									
		T											
TURBIDITY	FTU	R		1.030									
		T	1.060	.150									
URANIUM	UG/L-U	R	.330	.330									
		T	.290	.290									
CHLOROFORM	UG/L	R	*										
		T		22.000									
DICHLOROBROMOMETHANE	UG/L	R	*										
		T		12.000									
CHLORODIBROMOMETHANE	UG/L	R											
		T	*	5.000									
TOTAL TRIHALOMETHANES	UG/L	R	*										
		T		39.000									
ZINC	MG/L-ZN	R	.0[illegible]	.005									
		T	.006	.009									

* Sample identification error.